



## **Comments on revised ATLAS M&O Cost Estimates 2002 - 2007**

**Introduction** Following the request of the RRB Scrutiny Group (SG) in June 2001, ATLAS submitted to SG its M&O (A, B, C) cost estimates 2002 – 2007 in August further scrutiny. The results of the scrutiny were presented in the October 2001 RRB where 30% of M&O (A) was approved.

This document provides comments and clarifications to the updated M&O cost estimates 2002 – 2007 submitted to SG in February, 2002.

**Methodology** The methodology used to collect the M&O cost estimates is summarized in Table 1:

*Table 1. Methodology*

#	Step
1	Update the cost estimates from October 2001 by systems using the original template
2	For M&O (A), use the original template (with minor modifications)
3	For M&O (B), use the new template and guidelines provided by SG, using a “transformation matrix” to ensure a homogenous approach to cost item recording across the different systems (Appendix 1)
4	For M&O (B), provide cost estimates up to 2010 in order to include amortization of certain spares or infrastructure items 2007 – 2010 purchased under special financial arrangements before 2005 due to component availability and favorable cost
5	Collect plans on Institute technical manpower to be sent to CERN for installation and integration activities; identify what share is expected to be offered by Funding Agencies as in-kind contributions

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(Cont'd)

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**Assumptions** The assumptions made while providing the updated cost estimates are summarized in Table 2:

*Table 2. Assumptions*

#	Assumption
1	The initial ATLAS detector is ready for physics data taking by April 2006
2	Special funding arrangements set up for certain critical spares or infrastructure items are amortized between 2007-2010
3	Institute technical manpower includes technicians (and possibly engineers) sent to CERN for maintaining the respective systems, not accounted for by Funding Agencies as contributions to M&O
4	Hired manpower includes industrial personnel hired locally at CERN or institute personnel offered by Funding Agencies as in-kind contributions to M&O
5	The recognized value of a technician is 80 kCHF/year and for a qualified engineer (e.g. systems manager) 120 kCHF/year
6	Institute manpower originally planned for installation and integration work at CERN (and contained within the recognized integrated manpower effort of 5 315 man-years) is not part of hired institute manpower

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**M&O (A)** The following comments and clarifications are made to the collected M&O (A) cost estimates (Table 3):

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*Table 3. Comments, clarifications to M&O (A)*

#	Comment
1	Gas consumption is for ID (SR-building) and for the Muons; profile revised and reduced
2	Hydraulic systems: 2 operators are required for moving magnet and LArCC elements by pressurized air pads. Consumables ca 2% of capital value
3	Detector safety systems: 2% of capital value
4	UPS maintenance: Magnet & cryogenics supported by single unit (6 kVA) in B180 and two units (20 kVA) in USA15
5	Counting & control rooms: Counting room equipment under Category B, control rooms M&O 5% of capital value/year
6	Communications: includes GSMs for 10 persons (TCn and TDAQ)
7	Detector controls: electronics support to system test beam activities
8	Common Desktop: Activities before 2005 moved into C&I
9	Test beam/General operations: System specific activities (Cat B)
10	Common electronics: M&O levels reduce after 2005 to 20 kCHF/y (TDAQ ROB, PCs, monitors etc.)
11	Power: Profile changed and reduced based on revised estimates (Appendix 2)
12	Cranes: More costs shifted to ATLAS (6 crane operators required in 2003/2004)
13	Survey: 3 persons (PJAS) for monitoring the positioning of all detector elements
14	Academic subsistence: Reduced to 0 kCHF

The revised M&O (A) estimates for 2002 are lower by 750 kCHF w.r.t the projected cost estimates from October 2001. The difference is mostly due to changes in electricity

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profile (250 kCHF), gas and hydraulic systems (200 kCHF), laboratory operations (140 kCHF), heavy transport (net 60 kCHF) and subsistence/consultancy (100 kCHF).

The cumulative difference, mostly due to revised electricity cost estimates, amounts to 4 MCHF up to 2007.

**M&O (B)**

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The revised M&O (B) cost estimates are provided using the new template. Appendix 1 shows the guidelines used to translate the previous cost estimates from the original template.

Despite trying to ensure a homogenous approach across the different ATLAS systems, a number of apparent inconsistencies remained in the draft figures submitted to SG in early February.

Following its meeting on March 15, the ATLAS Executive Committee has further elaborated upon the cost estimates by systems in line with the endorsed detector deferral (staging) scenarios. These comments or corrections are summarized in Table 4:

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*Table 4. Comments, clarifications to M&O (B)*

#	Comment
1	ID: a. Under the new deferral plans, the Pixel B-layer is to be considered as an upgrade and should be removed from the tables b. Some institute personnel expected to be provided as technical manpower after 2006 (5 FTE/y)
2	LAr: a. Power supply spares are included in electronics pool rentals (20 kCHF/year after 2005) b. Some institute manpower offered as (hired) in-kind after 2005 (3 FTE/y)
3	TileCal: Some institute personnel expected to be provided as technical manpower after 2006 (2 FTE/y)
4	Muons (Revised estimates provided in new tables): a. Estimates for 2008-2010 at 1250 kCHF/y b. Provided technical manpower estimates include also personnel in institutes, overlap with hired (institute) manpower and are thus revised c. Spares advancement arrangement managed internally

In the tables provided (ID, LAr, Muons), item lines associated with special financial arrangements to obtain critical spares before 2005 are highlighted (in green). Actual planned payment profiles are provided for below the tables. In the case of the Muons, this is managed internally without requiring arrangements such as already in place for the LAr spares and what is being planned for the ID.

Concerning the distinction between offered institute in-kind (hired) and technical manpower, a global ATLAS policy is being developed for discussion in the

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(Cont'd)

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Collaboration Board. Any suggestions from SG would be welcome.


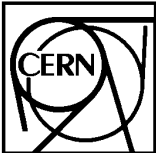
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**Conclusions** The following conclusions are made (Table 5):

*Table 5. Conclusions*

#	Conclusion
1	Comments and corrections are made to the M&O tables submitted to SG for further scrutiny

EXPERIMENT: ATLAS		New M&O(B) format													
	Previous M&O(B) format	Mech	Gas-s	Cryo-s	Cool	FE-el	Std-e-PS	Std-e-Cr	Std-e-R	Ctrl	Sub-d	Areas	Comm	Store	Hire-mp
	Detector related costs						x								
	Power supply														
	Gas systems														
	Gas consumption														
	Cooling systems														
	Cooling fluids(above −50°C)														
	Cryogenic fluids (below −50°C)														
	Moving/hydraulic systems														
	Shutdown activities														
	Detector (re-)integration & survey														
	General Technical support														
	UPS maintenance														
	Electronics pool rentals														
	Counting & control rooms														
	Communications														
	GSM phones														
	On-line computing														
	System management														
	Detector controls														
	Computers/processors/LANs														
	Software licenses														
	Test beams, calibration facilities														
	General operation														
	Common electronics														
	Counting & control rooms														
	Proximity cryogenics														
	Irradiations														
	Electronics pool rentals														
	Laboratory operations														
	Assembly areas, clean rooms, active storage areas														
	Workshops														
	Laboratory instruments														
	Electronics pool rentals														
	General services														
	Cranes														
	Survey														
	Consultancy														
	Engineering														

		<b>Power Consumption Estimation</b>	
<i>ATLAS Project Document. No.</i> <i>Project - System -- Type - Sequential No .</i>	<i>Institute Document No.</i>	<i>Created</i> 10-01-2002	<i>Page</i> 1 of 10
		<i>Modified</i>	<i>Rev. No.</i> <b>1</b>

## ATLAS POWER CONSUMPTION ESTIMATION

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## **1. Introduction**

We are summarizing here the present knowledge of the power consumption for ATLAS in point 1 and in the assembly buildings year by year starting in 2002 up to 2006. For this exercise we base our self on the present LHC schedule, with a pilot run in April 2006.

## **2. Power consumption inside ATLAS during normal operations**

### LV power consumption

- ID (see ATL-IC-EN-0009 – Inner Detector Thermal Management page 19)
  - LV power supplies are in USA15
  - Total power consumption is in the order of 140 kW (including electronics, cables, heaters) Cost 35 wks = 823200 kWh + additional 17 wks to keep SCT&Pixel cold 15kW > 37800 kWh , > TOTAL ~ 861000 kWh
- LAr
  - 255 kW to be cooled in the electronics boxes so it has to be delivered. If including some efficiency of PS and losses in cables around 300 kW should be delivered in 35 wks 1764000 kWh
- TileCal
  - 77 kW to be cooled in superdrawers, including efficiency of PS 80% around 100 kW to be delivered. 100 in 35 wks > 588000 kWh
- Muon (information from the table “Power consumption of the ATLAS Muon system”)
  - Total power delivered by PS 132 kW , 132 in 35 wks > 776160 kWh
- Magnet - separately treated (section 3)

Total - 3989160 kWh

### LAr cryo

- 300 kW for the refrigerator + 225 kW for the cryo control 525 kW 52 wks > 4586400 kWh
- 150 kW is the power installed in bldg. 180 for the tests

### Cooling systems consumption

- Heat load inside UX15 – 900 kW – power consumption will not exceed 10% so 90 kW is a maximum 90 in 52 weeks > 786240 kWh
- Electronics racks 2500 kW – power consumption around 300 kW 52 wks > 2620800 kWh
- Dumps circuit 350 kW – power consumption ~30 kW 35 wks > 176400 kWh
- Bus bars circuit 225 kW – power consumption 20 kW 35 wks > 117600 kWh

Total - 3701000 kWh

### HVAC fans and heaters

- USA 15
  - Fans motors 140 kW 52 wks > 1,223,040 kWh >
  - Heating 450 kW (*during running heaters will not be necessary at the full power, let say 10% during shutdown and 100 % during the moist season*) 5wks > 415,800 kWh

Total – 1,638,840 kWh

- UX15
  - Fans motors 240 kW 52 wks > 2,096,640 kWh
  - Heaters 700 kW (*100 % during the shutdown plus 50 % during the moist season*) 5 wks > 882,000 kWh

Total – 2,978,640 kWh

- Others surface buildings
  - Fans motors 390 kW 52 wks > 3,415,776 kWh
  - Heaters 1505 kW 75% 20 wks > 3,792,600 kWh

Total > 7,208,376 kWh

### Chilled water production for SUXI

(from the document F310/ST/LHC-LS/1/005, updated 23/01/01)), 2575 kW installed power

- Pumps 500 kW 35 wks > 2,940,000 kWh
- Chillers 2000 kW 35 wks > 11,760,000 kWh

Total 14,700,000 kWh

### SF1 Cooling Towers

(CERN POMPAGE IT 2522/ST/LHC from 23/02/01), 1026 kW installed power

- Cooling towers
  - Pumps 330 kW 40 wks > 2,217,600 kWh
  - Fans 180 kW (100% 6 months + 40% 4 months) > 756000 kWh + 193536 kWh > 949,536 kWh

Total 3,167,136 kWh

### Cranes & Lifts

631 kW installed power, assumes 30% operation time in average, peak activity in 2004

- Cranes SDX1=45 kW, SUX1=11 kW, SH1=14 kW, SX1=271 kW, UX15=216 kW
- Hoist USA15 = 14 kW , Lifts SCX1=16 kW, PX15=44 kW

### 3. Magnet power consumption

A) Power consumption during Magnet testing in H180 (excl building infrastructure, ligths, cranes etc)

Item	P[KW]	BT1-8 Hrs	year	B1-2 <b>2002</b> kWh	BT3-4-5-6+CS <b>2003</b> kWh	BT7-8 <b>2004</b> kWh	ECT1-2 <b>2005</b> kWh
power supply	50	40		4000	15200	10000	8000
water cooling	5	40		400	1520	1000	800
vacuum	10	1190		23800	90440	59500	47600
controls 2.5+UPS 0.5	3	8736	52wks	26208	26208	26208	26208
cryotests	510	672	6wks	342720			
cryogenics standby	3	8736	52wks	26208	99590	65520	52416
cryog. cooling (510 frig+160 prec)	670	500	3wks	335000	1273000	837500	670000
cryogenics normal	510	336	3wks	171360	651168	428400	342720
sums	1761			929698	2157130	1428131	1147746

B) Power consumption in Point 1 (BT + 2 ECT + CS)

Item	P[KW]	test L'AL <b>2003</b>		test Linde <b>2004</b>		system test <b>2005</b>		at50% <b>2006</b>		at100% <b>2007</b>	
		wks	kWh	wks	kWh	wks	kWh	wks	kWh	wks	kWh
power supply	110					2	36960	20	369600	30	554400
water cooling	0					2		20		35	
vacuum	30					20	100800	52	262080	52	262080
controls 4.5+UPS 0.5	5					20	16800	52	43680	52	43680
proximity cryogenics	15					10	25200	26	65520	35	88200
cryogenics test	0	6	2903040	8	4892160						
cryogenics standby	780					14	1834560	26	3407040	17	2227680
cryogenics cooling	3640					4	2446080	2	1223040	2	1223040
cryogenics normal	2880					2	967680	24	11612160	33	1596672
sums	7460		2903040		4892160		5428080		16983120		20365800

**M&O Cost Estimates in kCHF ATLAS M&O (A) ESTIMATES (kCHF) SUMMARY (Magnets, TDAQ, TCn)**

M=Maintenance/Repairs

O=Operations

C=Consumables

EP-ATO/mn/070302

			2002	2003	2004	2005	2006	2007	TOTAL	
Detector related costs	Type		19	242	457	2,107	4,413	4,413	11,651	
Magnet	A	O	0	0	0	40	40	40	120	Magnets: 0.5 FTE/y (engineer) < 05, 0.3 FTE/y thereafter
	A	C	0	0	0	50	50	50	150	Magnets: Repairs for 3 pumps < 05, 10 active thereafter
Magnet controls	A	O	0	0	0	210	180	180	570	Magnets: Numbers from D Schinzel
	A	C	0	0	0	59	45	45	149	Magnets: Numbers from D Schinzel
Magnet power supply	A	O	4	12	12	8	8	8	52	Magnets: Numbers from D Schinzel
	A	C	5	15	15	75	75	75	260	Magnets: Numbers from D Schinzel TDAQ: ROB in power
Gas systems	A	O	0	0	50	50	50	50	200	TCn-Gen: Service contract
	A	C	0	0	0	50	100	100	250	
Gas consumption	A	O	0	0	0	0	0	0	0	
	A	C	0	70	70	150	200	200	690	TCn-Gen: Gas consumption for ID and muons. Starts with SR1 and assembly halls for muons in 2003
Cooling systems	A	O	0	10	120	120	120	120	490	Magnets: 0.1 FTE/y (technician) TCn-Gen: 1 FTE/y (technician).
	A	C	0	5	10	45	45	45	150	Magnets: Pumps, filters, cooling towers TCn-Gen: 2% of investment running time
Cooling fluids(above -50°C)	A	O	5	5	5	5	5	5	30	
	A	C	5	5	25	25	75	75	210	Magnets: Demin & tap water pumps, filters TCn-Gen: Demineralized water, carbo-fluids etc.
External cryogenics	A	O	0	0	0	700	1,040	1,040	2,780	Magnets: Numbers from D Schinzel.M&O + C&I for Point
	A	C	0	0	0	320	430	430	1,180	Magnets: M&Ofor Cryogenics spares, fluids etc. Liquid He, N
Cryogenic fluids (below -50°C)	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Moving/hydraulic systems	A	O	0	100	100	100	50	50	400	TCn-Gen: LAr/Magnet from B180&191
	A	C	0	20	20	20	40	40	140	TCn-Gen: 2% of the capital investment
Detector safety systems	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	30	60	60	150	TCn-Gen: 2% of capital value
Shutdown activities	A	O	0	0	0	0	400	400	800	TCn-Gen: Crew to operate and prepare shutdown and to run general maintenance of ATLAS. 4 FTE @ 100 kCHF/y, starting at running time.
	A	C	0	0	0	0	50	50	100	TCn-Gen: Consumables (mechanical shop)
General Technical support	A	O	0	0	0	0	300	300	600	TCn-Gen: Crew to operate and maintain ATLAS technical
	A	C	0	0	0	0	660	660	1,320	TDAQ: 5% of ROB&infra installed. Independent of staging.
UPS maintenance	A	O	0	0	0	0	0	0	0	
	A	C	0	0	30	50	50	50	180	TCn-Gen: 2% of capital investment
Electronics pool rentals	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Beam pipe & vacuum	A	O	0	0	0	0	120	120	240	TCn-Gen: Numbers from T Camporesi
	A	C	0	0	0	0	120	120	240	
Counting & control rooms	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	100	100	200	TCn-Gen: 5% of capital investment. Counting room eqpm in B
Secretariat	Type		40	110	155	215	270	290	1,080	
Secretarial assistance	A	O	0	45	90	140	140	140	555	TCn-Gen: 2 FTE @ 75 kCHF/y (D Schinzel guideline)
	A	C	0	0	0	0	0	0	0	
Economat	A	O	0	0	0	0	0	0	0	
	A	C	10	15	15	15	20	20	95	
Fax, photocopiers, printers	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Printing and publication	A	O	0	0	0	0	0	0	0	

	A	C	30	50	50	60	110	130	430	TCn-Gen: Pens, folders, transparencies, note paper
<b>Communications</b>	<b>Type</b>		<b>0</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>70</b>	
GSM phones; on-call service	A	O	0	0	0	0	0	0	0	
	A	C	0	10	10	10	10	10	50	TDAQ: Included in TCn TCn-Gen: TDAQ:5 persons + TCN:5 persons; 1kCHF/y
Automatic call-back	A	O	0	0	0	0	0	0	0	
	A	C	0	0	5	5	5	5	20	TCn-Gen: 10 persons on call
<b>On-line computing</b>	<b>Type</b>		<b>75</b>	<b>75</b>	<b>530</b>	<b>1,690</b>	<b>2,925</b>	<b>3,945</b>	<b>9,240</b>	
System management	A	O	0	0	120	480	600	600	1,800	TDAQ: In 06, (2 FTE/farm x2 + 1FTE/shift)@120kCHF/y; 1FTE/300 boxes
	A	C	0	0	0	0	0	0	0	
Data storage, (temporary on disk)	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Detector controls	A	O	0	0	0	0	0	0	0	
	A	C	20	20	20	30	30	30	150	TCn-Gen: DCS (PCB, cabling, connectors, interfaces)
Computers/processors/LANs	A	O	0	0	0	0	0	0	0	
	A	C	0	0	300	1,000	2,040	3,060	6,400	TDAQ: <15-20%> repl./y. 25% repl. rate on processors TCn-Gen: DCS (test beam instrumentation, radiation testing)
Software licenses	A	O	0	0	0	0	0	0	0	
	A	C	55	55	90	150	225	225	800	TDAQ: For LVL2 (1000), EF (1000), servers (50); code-checking
Common desktop infrastructure	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	30	30	30	90	TCn-Gen: PCs, WS, terminals for on-line mgmt tasks
<b>Test beams, calibration facilities</b>	<b>Type</b>		<b>720</b>	<b>710</b>	<b>785</b>	<b>140</b>	<b>65</b>	<b>65</b>	<b>2,485</b>	
General operation	A	O	240	240	240	0	0	0	720	TDAQ: On-line computing mgmt for test beams
	A	C	0	0	0	0	0	0	0	
Common electronics	A	O	0	0	0	0	0	0	0	
	A	C	85	95	95	95	20	20	410	TDAQ: ROBs, PCs, monitors, terminals TCn-Gen: DCS (test beam instrumentation, radiation testing outside CERN)
Electronics pool rentals	A	O	0	0	0	0	0	0	0	
	A	C	60	60	60	45	45	45	315	TDAQ: RIO2,NIM
Gas systems	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Gas consumption	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
External cryogenics	A	O	260	260	340	0	0	0	860	Magnets: Hall 180
	A	C	75	55	50	0	0	0	180	Magnets: Hall 180
<b>Laboratory operations</b>	<b>Type</b>		<b>20</b>	<b>80</b>	<b>130</b>	<b>115</b>	<b>75</b>	<b>75</b>	<b>495</b>	
Assembly areas, clean rooms, active storage areas	A	O	0	0	0	0	0	0	0	
	A	C	0	50	100	50	0	0	200	
Workshops	A	O	0	0	0	0	0	0	0	
	A	C	0	10	10	10	20	20	70	
Laboratory instruments	A	O	0	0	0	0	0	0	0	
	A	C	20	20	20	55	55	55	225	TDAQ: Lab eqpm in B513,32,40 (VME, network). PCs, testers
<b>General services</b>	<b>Type</b>		<b>288</b>	<b>1,186</b>	<b>1,863</b>	<b>2,461</b>	<b>3,959</b>	<b>4,024</b>	<b>13,781</b>	
Cooling & ventilation	A	O	36	73	109	146	182	182	728	TCn-Gen: D Schinzel/M Wilhelmson input

	A	C	36	73	109	146	182	182	728	TCn-Gen: D Schinzel/M Wilhelmson input
Power	A	O	0	0	0	0	0	0	0	
	A	C	80	560	1,030	1,470	2,820	3,010	8,970	TCn-Gen: See separate note by M Nessi 10-01-2002
Power distribution system	A	O	0	0	0	0	0	0	0	
	A	C	0	20	25	25	35	35	140	TCn-Gen: Service contract (ST) for periodic inspection of power connections
Heavy transport	A	O	0	60	60	60	60	60	300	TCn-Gen: Area mgmt (safety, cleaning, storage)
	A	C	0	0	0	0	0	0	0	
Cranes	A	O	0	60	60	60	120	120	420	TCn-Gen: 7 cranes in Pit 1, 6 operators @60kCHF/FTE '03-05 of
	A	C	5	30	60	60	60	60	275	TCn-Gen: 1.5% of capital value/y
Cars	A	O	0	0	0	0	0	0	0	
	A	C	0	30	30	30	30	30	150	TCn-Gen: CERN cars for TCn operate at Point 1
Cleaning	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Survey	A	O	60	110	210	210	110	60	760	TCn-Gen: See note from C Lasseur
	A	C	0	0	0	0	0	0	0	
Passive storage space	A	O	0	0	0	0	0	0	0	
	A	C	0	0	0	0	0	0	0	
Common desktop infrastructure	A	O	0	0	0	0	0	0	0	
	A	C	20	20	20	30	30	30	150	TCn-Gen: PCs, WSs, terminals for technical crews
Academic subsistence	A	O	0	100	100	100	130	130	560	Academic subsistence. Entry requested by SG
	A	C	0	0	0	0	0	0	0	
Outreach	A	O	0	0	0	50	100	50	200	TCn-Gen: PJAS to run website (media events)
	A	C	50	50	50	75	100	75	400	TCn-Gen: Material for schools, public
GRAND TOTALS			1,162	2,413	3,935	6,743	11,722	12,827	38,802	

**M&O Cost Estimates in kCHF**      **ATLAS M&O (Cat C) ESTIMATES (kCHF) SUMMARY (Magnets, T)**

M=Maintenance/Repairs

O=Operations

C=Consumables

EP-ATO/mn/310102

			2002	2003	2004	2005	2006	2007	TOTAL
<b>General services</b>	<b>Type</b>		570	560	675	635	755	815	4,010
Cooling & ventilation	C	O	16	31	47	62	78	78	312
	C	C	16	31	47	62	78	78	312
Safety & radioprotection	C	O	0	0	0	0	0	0	0
	C	C	0	0	0	0	30	60	90
INB compliance	C	O	160	160	160	120	80	80	760
	C	C	10	10	10	10	10	10	60
Radioactive waste disposal	C	O	0	0	0	0	0	0	0
	C	C	0	0	0	0	30	60	90
Access system	C	O	0	0	0	0	0	0	0
	C	C	20	20	60	60	60	60	280
Elevators	C	O	0	0	0	0	0	0	0
	C	C	15	15	30	30	30	30	150
Gerant de site	C	O	250	250	250	250	250	250	1,500
	C	C	10	10	10	10	10	10	60
Flood control	C	O	0	0	0	0	0	0	0
	C	C	30	20	20	20	20	20	130
Insurance (CERN standard)	C	O	0	0	0	0	0	0	0
	C	C	50	50	100	100	200	200	700
Cleaning	C	O	10	10	15	15	15	15	80
	C	C	0	0	0	0	0	0	0
Office space	C	O	0	0	0	0	0	0	0
	C	C	15	15	20	20	20	20	110
<b>GRAND TOTALS</b>			570	560	675	635	755	815	4,010

**M&O Cost Estimates in  
kCHF**

**ATLAS M&O ESTIMATES (kCHF) FOR MAGNETS**

M=Maintenance/Repairs

O=Operations

EP-ATO/mm/300102

			2002	2003	2004	2005	2006	2007	TOT	Notes
<b>Detector related costs</b>	<b>Type</b>		<b>19</b>	<b>52</b>	<b>57</b>	<b>1,432</b>	<b>1,838</b>	<b>1,838</b>	<b>5,236</b>	
Magnet	A	O				40	40	40	120	0.5 FTE/y (engineer) < 05, 0.3 FTE/y thereafter
	A	C				50	50	50	150	Repairs for 3 pumps < 05, 10 active thereafter
Magnet controls	A	O				210	180	180	570	Numbers from D Schinzel
	A	C				59	45	45	149	Numbers from D Schinzel
Magnet power supply	A	O	4	12	12	8	8	8	52	Numbers from D Schinzel
	A	C	5	15	15	10	10	10	65	Numbers from D Schinzel
Gas systems	A	O							0	
	A	C							0	
Gas consumption	A	O							0	
	A	C							0	
Cooling systems	A	O		10	10	10	10	10	50	0.1 FTE/y (technician)
	A	C		5	10	15	15	15	60	Pumps, filters, cooling towers
Cooling fluids(above -50°C)	A	O	5	5	5	5	5	5	30	
	A	C	5	5	5	5	5	5	30	Demin & tap water pumps, filters
External cryogenics	A	O				700	1,040	1,040	2,780	Numbers from D Schinzel. M&O + C&I for Point 1. Note: Hall 180 activities are under Test beams
	A	C				320	430	430	1,180	M&O for Cryogenics spares, fluids etc. Liquid He, N
Proximity cryogenics	A	O							0	
	A	C							0	
Cryogenic fluids (below -50°C)	A	O							0	
	A	C							0	
Moving/hydraulic systems	A	O							0	
	A	C							0	
Detector safety systems	A	O							0	
	A	C							0	
Detector-specific radiation protection	A	O							0	
	A	C							0	
Shutdown activities	A	O							0	
	A	C							0	
Detector (re-)integration & survey	A	O							0	
	A	C							0	
General Technical support	A	O							0	
	A	C							0	
UPS maintenance	A	O							0	
	A	C							0	
Electronics pool rentals	A	O							0	
	A	C							0	
Beam pipe & vacuum	A	O							0	
	A	C							0	
Counting & control rooms	A	O							0	
	A	C							0	
<b>Secretariat</b>	<b>Type</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Secretarial assistance	A	O							0	
	A	C							0	
Economat	A	O							0	
	A	C							0	
Fax, photocopiers, printers	A	O							0	
	A	C							0	
Printing and publication	A	O							0	
	A	C							0	
<b>Communications</b>	<b>Type</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
GSM phones	A	O							0	
	A	C							0	
GSM phones	B	O							0	
	B	C							0	
Automatic call-back	A	O							0	
	A	C							0	
Automatic call-back	B	O							0	
	B	C							0	
<b>On-line computing</b>	<b>Type</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
									0	
System management	A	O							0	
	A	C							0	
Data storage, (temporary on disk)	A	O							0	
	A	C							0	
Detector controls	A	O							0	
	A	C							0	
Computers/processors/LANs	A	O							0	
	A	C							0	
Software licenses	A	O							0	



	A	C							0
Common desktop infrastructure	A	O							0
	A	C							0
<i>Test beams, calibration facilities</i>	<i>Type</i>		335	315	390	0	0	0	1,040
General operation	A	O							0
	A	C							0
Common electronics	A	O							0
	A	C							0
Electronics and DAQ	B	O							0
	B	C							0
Counting & control rooms	A	O							0
	A	C							0
Gas systems	A	O							0
	A	C							0
Gas consumption	A	O							0
	A	C							0
Gas systems	B	O							0
	B	C							0
Gas consumption	B	O							0
	B	C							0
External cryogenics	A	O	260	260	340				860 Hall 180
	A	C	75	55	50				180 Hall 180
Proximity cryogenics	A	O							0
	A	C							0
Safety & radioprotection	A	O							0
	A	C							0
Irradiations	B	O							0
	B	C							0
Modifications	A	O							0
	A	C							0
Modifications	B	O							0
	B	C							0
Electronics pool rentals	A	O							0
	A	C							0
Electronics pool rentals	B	O							0
	B	C							0
<i>Laboratory operations</i>	<i>Type</i>		0	0	0	0	0	0	0
Assembly areas, clean rooms, active storage areas	A	O							0
	A	C							0
Assembly areas, clean rooms, active storage areas	B	O							0
	B	C							0
Workshops	A	O							0
	A	C							0
Workshops	B	O							0
	B	C							0
Laboratory instruments	A	O							0
	A	C							0
Laboratory instruments	B	O							0
	B	C							0
Electronics pool rentals	A	O							0
	A	C							0
Electronics pool rentals	B	O							0
	B	C							0
<i>General services</i>	<i>Type</i>		0	0	0	0	0	0	0
Cooling & ventilation	A	O							0
	A	C							0
Power	A	O							0
	A	C	0	0	0	0	0	0	0
Power distribution system	A	O							0
	A	C							0
Heavy transport	A	O							0
	A	C							0
Cranes	A	O							0
	A	C							0
Cars	A	O							0
	A	C							0
Cars	B	O							0
	B	C							0
Safety & radioprotection	C	O							0
	C	C							0
INB compliance	C	O							0
	C	C							0
Radioactive waste disposal	C	O							0
	C	C							0
Access system	C	O							0

	C	C	0
Elevators	C	O	0
	C	C	0
Gerant de site	C	O	0
	C	C	0
Flood control	C	O	0
	C	C	0
Insurance (CERN standard)	C	O	0
	C	C	0
Cleaning	A	O	0
	A	C	0
Cleaning	C	O	0
	C	C	0
Survey	A	O	0
	A	C	0
Survey	B	O	0
	B	C	0
Passive storage space	A	O	0
	A	C	0
Passive storage space	B	O	0
	B	C	0
Common desktop infrastructure	A	O	0
	A	C	0
Office space	C	O	0
	C	C	0

Consultancy	Type	0	0	0	0	0	0	0
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Reviewing	A	O	0
	A	C	0
Engineering	A	O	0
	A	C	0
Training	A	O	0
	A	C	0

Outreach	Type	0	0	0	0	0	0	0
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Outreach	A	O	0
	A	C	0

GRAND TOTALS	354	367	447	1,432	1,838	1,838	6,276
A TOTAL	354	367	447	1,432	1,838	1,838	6,276
B TOTAL	0	0	0	0	0	0	0
C TOTAL	0	0	0	0	0	0	0

# SUMMARY OF ATLAS MAGNETS PER TYPE

## Magnets

	2002	2003	2004	2005	2006	2007	Total	
Mechanics	O	5	15	15	55	55	55	200 Incl. Gen services
	C	5	10	15	70	70	70	240
Electronics	O	4	12	12	218	188	188	622
	C	5	15	15	69	55	55	214
Cryogenics	O	260	260	340	700	1,040	1,040	3,640
	C	75	55	50	320	430	430	1,360
TOTALS		354	367	447	1,432	1,838	1,838	6,276

**M&O Cost Estimates in  
kCHF**

**ATLAS M&O ESTIMATES (kCHF) FOR TDAQ**

M=Maintenance/Repairs

O=Operations

EP-ATO/mn/070302

			2002	2003	2004	2005	2006	2007	TOTAL	Notes
<b>Detector related costs</b>	<b>Type</b>		0	0	0	65	675	675	1,415	
Dummy	A	O							0	
	A	C							0	
Dummy	A	O							0	
	A	C							0	
Magnet power supply	A	O							0	
	A	C				65	65	65	195	ROBs in power crates, Racks for LVL1
Gas systems	A	O							0	
	A	C							0	
Gas consumption	A	O							0	
	A	C							0	
Cooling systems	A	O							0	
	A	C							0	
Cooling fluids(above -50°C)	A	O							0	
	A	C							0	
External cryogenics	A	O							0	
	A	C							0	
Proximity cryogenics	A	O							0	
	A	C							0	
Cryogenic fluids (below -50°C)	A	O							0	
	A	C							0	
Moving/hydraulic systems	A	O							0	
	A	C							0	
Detector safety systems	A	O							0	
	A	C							0	
Detector-specific radiation protection	A	O							0	
	A	C							0	
Shutdown activities	A	O							0	
	A	C							0	
Detector (re-)integration & survey	A	O							0	
	A	C							0	
General Technical support	A	O							0	
	A	C					610	610	1,220	5% of ROBs&infra installed. Independent of staging. Cables, connectors
UPS maintenance	A	O							0	
	A	C							0	
Electronics pool rentals	A	O							0	
	A	C							0	
Beam pipe & vacuum	A	O							0	
	A	C							0	
Counting & control rooms	A	O							0	
	A	C							0	
<b>Secretariat</b>	<b>Type</b>		0	0	0	0	0	0	0	
Secretarial assistance	A	O							0	
	A	C							0	
Economat	A	O							0	
	A	C							0	
Fax, photocopiers, printers	A	O							0	
	A	C							0	
Printing and publication	A	O							0	
	A	C							0	
<b>Communications</b>	<b>Type</b>		0	0	0	0	0	0	0	
GSM phones	A	O							0	
	A	C	0	0	0	0	0	0	0	Included in TCn
GSM phones	B	O							0	
	B	C							0	
Automatic call-back	A	O							0	
	A	C							0	
Automatic call-back	B	O							0	
	B	C							0	
<b>On-line computing</b>	<b>Type</b>		15	15	470	1,580	2,755	3,775	8,610	
System management	A	O	0	0	120	480	600	600	1,800	In 06, (2 FTE/farm x2 + 1FTE/shift)@ 120kCHF/y; 1FTE/300 boxes
	A	C							0	
Data storage, (temporary on disk)	A	O							0	
	A	C							0	
Detector controls	A	O							0	
	A	C							0	
Computers/processors/LANs	A	O							0	
	A	C			300	1,000	2,000	3,020	6,320	<15-20%> repl./y. 25% repl. rate on processors
Software licenses	A	O							0	
	A	C	15	15	50	100	155	155	490	For LVL2 (1000), EF (1000), servers (50); code-checking 02/03

Common desktop infrastructure	A	O							0
	A	C							0

<i>Test beams, calibration facilities</i>	Type		340	340	340	70	20	20	1,130
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General operation	A	O	240	240	240				720	On-line computing mgmt for test beams
	A	C							0	
Common electronics	A	O							0	
	A	C	70	70	70	70	20	20	320	ROBs, PCs, monitors, terminals
Electronics and DAQ	B	O							0	
	B	C							0	
Counting & control rooms	A	O							0	
	A	C							0	
Gas systems	A	O							0	
	A	C							0	
Gas consumption	A	O							0	
	A	C							0	
Gas systems	B	O							0	
	B	C							0	
Gas consumption	B	O							0	
	B	C							0	
External cryogenics	A	O							0	
	A	C							0	
Proximity cryogenics	A	O							0	
	A	C							0	
Safety & radioprotection	A	O							0	
	A	C							0	
Irradiations	B	O							0	
	B	C							0	
Modifications	A	O							0	
	A	C							0	
Modifications	B	O							0	
	B	C							0	
Electronics pool rentals	A	O							0	
	A	C	30	30	30				90	RIO2,NIM
Electronics pool rentals	B	O							0	
	B	C							0	

<i>Laboratory operations</i>	Type		50	50	50	100	100	100	450
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Assembly areas, clean rooms, active storage areas	A	O							0	
	A	C							0	
Assembly areas, clean rooms, active storage areas	B	O							0	
	B	C							0	
Workshops	A	O							0	
	A	C							0	
Workshops	B	O							0	
	B	C							0	
Laboratory instruments	A	O							0	
	A	C	20	20	20	55	55	55	225	Lab eqpm in B513,32,40 (VME, network). PCs, testers
Laboratory instruments	B	O							0	
	B	C							0	
Electronics pool rentals	A	O							0	
	A	C	30	30	30	45	45	45	225	RIO2
Electronics pool rentals	B	O							0	
	B	C							0	

<i>General services</i>	Type		0	0	0	0	0	0	0
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Cooling & ventilation	A	O							0
	A	C							0
Power	A	O							0
	A	C							0
Power distribution system	A	O							0
	A	C							0
Heavy transport	A	O							0
	A	C							0
Cranes	A	O							0
	A	C							0
Cars	A	O							0
	A	C							0
Cars	B	O							0
	B	C							0
Safety & radioprotection	C	O							0
	C	C							0
INB compliance	C	O							0
	C	C							0
Radioactive waste disposal	C	O							0
	C	C							0
Access system	C	O							0
	C	C							0

Elevators	C	O	0
	C	C	0
Gerant de site	C	O	0
	C	C	0
Flood control	C	O	0
	C	C	0
Insurance (CERN standard)	C	O	0
	C	C	0
Cleaning	A	O	0
	A	C	0
Cleaning	C	O	0
	C	C	0
Survey	A	O	0
	A	C	0
Survey	B	O	0
	B	C	0
Passive storage space	A	O	0
	A	C	0
Passive storage space	B	O	0
	B	C	0
Common desktop infrastructure	A	O	0
	A	C	0
Office space	C	O	0
	C	C	0

<b>Consultancy</b>	<b>Type</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
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Reviewing	A	O	0
	A	C	0
Engineering	A	O	0
	A	C	0
Training	A	O	0
	A	C	0

<b>Outreach</b>	<b>Type</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
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Outreach	A	O	0
	A	C	0

<b>GRAND TOTALS</b>	<b>405</b>	<b>405</b>	<b>860</b>	<b>1,815</b>	<b>3,550</b>	<b>4,570</b>	<b>11,605</b>
A TOTAL	405	405	860	1,815	3,550	4,570	11,605
B TOTAL	0	0	0	0	0	0	0
C TOTAL	0	0	0	0	0	0	0

#### SUMMARY OF ATLAS

#### TDAQ PER TYPE

<b>TDAQ</b>		<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>Total</b>
Mechanics	O	240	240	240	0	0	0	720
	C	0	0	0	0	610	610	1,220
Electronics	O	0	0	120	480	600	600	1,800
	C	165	165	500	1,335	2,340	3,360	7,865
Cryogenics	O	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0
TOTALS		405	405	860	1,815	3,550	4,570	11,605

**M&O Cost Estimates in kCHF**
**ATLAS M&O ESTIMATES (kCHF) FOR TECH. COORD & GENERAL**

M=Maintenance/Repairs

O=Operations

C=Consumables

EP-ATO/mn/070302

			2002	2003	2004	2005	2006	2007	TOTAL	Notes
Detector related costs	Type		0	190	400	610	1,900	1,900	5,000	
Magnet	A	O							0	
	A	C							0	
Magnet controls	A	O							0	
	A	C							0	
Magnet power supply	A	O							0	
	A	C							0	
Gas systems	A	O	0	0	50	50	50	50	200	Service contract
	A	C				50	100	100	250	
Gas consumption	A	O							0	
	A	C	0	70	70	150	200	200	690	Gas consumption for ID and muons. Starts with SR1 and assembly hall:
Cooling systems	A	O	0	0	110	110	110	110	440	1 FTE/y (technician).
	A	C				30	30	30	90	2% of investment running time
Cooling fluids(above -50°C)	A	O							0	
	A	C			20	20	70	70	180	Demineralized water, carbo-fluids etc.
External cryogenics	A	O							0	
	A	C							0	
Proximity cryogenics	A	O							0	
	A	C							0	
Cryogenic fluids (below -50°C)	A	O							0	
	A	C							0	
Moving/hydraulic systems	A	O	0	100	100	100	50	50	400	LAr/Magnet from B180&191
	A	C		20	20	20	40	40	140	2% of the capital investment
Detector safety systems	A	O							0	
	A	C				30	60	60	150	2% of capital value
Detector-specific radiation protection	A	O							0	
	A	C			0	0	0	0	0	Incl. in safety
Shutdown activities	A	O					400	400	800	Crew to operate and prepare shutdown and to run general maintenance
	A	C					50	50	100	Consumables (mechanical shop)
Detector (re-)integration & survey	A	O							0	
	A	C								
General Technical support	A	O	0	0	0	0	300	300	600	Crew to operate and maintain ATLAS technical services, example sup
	A	C	0	0	0	0	50	50	100	Consumables (mechanical shop)
UPS maintenance	A	O							0	
	A	C		0	30	50	50	50	180	2% of capital investment
Electronics pool rentals	A	O							0	
	A	C							0	
Beam pipe & vacuum	A	O					120	120	240	Numbers from T Camporesi
	A	C					120	120	240	
Counting & control rooms	A	O							0	
	A	C					100	100	200	5% of capital investment. Counting room eqpm in B
Secretariat	Type		40	110	155	215	270	290	1,080	
Secretarial assistance	A	O		45	90	140	140	140	555	2 FTE @ 75 kCHF/y (D Schinzel guideline)
	A	C							0	
Economat	A	O							0	
	A	C	10	15	15	15	20	20	95	
Fax, photocopiers, printers	A	O							0	
	A	C							0	
Printing and publication	A	O							0	
	A	C	30	50	50	60	110	130	430	Pens, folders, transparencies, note paper
Communications	Type		0	10	15	15	15	15	70	
GSM phones	A	O							0	
	A	C	0	10	10	10	10	10	50	TDAQ:5 persons + TCN:5 persons; 1kCHF/y
GSM phones	B	O							0	
	B	C							0	
Automatic call-back	A	O							0	
	A	C	0	0	5	5	5	5	20	10 persons on call
Automatic call-back	B	O							0	
	B	C							0	
On-line computing	Type		60	60	60	110	170	170	630	
									0	
System management	A	O							0	
	A	C							0	
Data storage, (temporary on disk)	A	O							0	
	A	C							0	
Detector controls	A	O							0	
	A	C	20	20	20	30	30	30	150	DCS (PCB, cabling, connectors, interfaces)
Computers/processors/LANs	A	O							0	
	A	C					40	40	80	DCS (test beam instrumentation, radiation testing)
Software licenses	A	O							0	
	A	C	40	40	40	50	70	70	310	DCS SCADA, design

Common desktop infrastructure	A	O							0	
	A	C	0	0	0	30	30	30	90	PCs, WS, terminals for on-line mgmt tasks
<b>Test beams, calibration facilities</b>	<b>Type</b>		<b>15</b>	<b>25</b>	<b>25</b>	<b>25</b>	<b>0</b>	<b>0</b>	<b>90</b>	
General operation	A	O							0	
	A	C							0	
Common electronics	A	O							0	
	A	C	15	25	25	25			90	DCS (test beam instrumentation, radiation testing outside CERN)
Electronics and DAQ	B	O							0	
	B	C							0	
Counting & control rooms	A	O							0	
	A	C							0	
Gas systems	A	O							0	
	A	C							0	
Gas consumption	A	O							0	
	A	C							0	
Gas systems	B	O							0	
	B	C							0	
Gas consumption	B	O							0	
	B	C							0	
External cryogenics	A	O							0	
	A	C							0	
Proximity cryogenics	A	O							0	
	A	C							0	
Safety & radioprotection	A	O							0	
	A	C							0	
Irradiations	B	O							0	
	B	C							0	
Modifications	A	O							0	
	A	C							0	
Modifications	B	O							0	
	B	C							0	
Electronics pool rentals	A	O							0	
	A	C							0	
Electronics pool rentals	B	O							0	
	B	C							0	
<b>Laboratory operations</b>	<b>Type</b>		<b>0</b>	<b>60</b>	<b>110</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>270</b>	
Assembly areas, clean rooms, active storage areas	A	O							0	
	A	C	0	50	100	50			200	
Assembly areas, clean rooms, active storage areas	B	O							0	
	B	C							0	
Workshops	A	O							0	
	A	C		10	10	10	20	20	70	Special cleaning of lab areas (SR)
Workshops	B	O							0	
	B	C							0	
Laboratory instruments	A	O							0	
	A	C							0	
Laboratory instruments	B	O							0	
	B	C							0	
Electronics pool rentals	A	O							0	
	A	C							0	
Electronics pool rentals	B	O							0	
	B	C							0	
<b>General services</b>	<b>Type</b>		<b>238</b>	<b>1,036</b>	<b>1,713</b>	<b>2,236</b>	<b>3,629</b>	<b>3,769</b>	<b>12,621</b>	
Cooling & ventilation	A	O	36	73	109	146	182	182	728	D Schinzel/M Wilhelmson input
	A	C	36	73	109	146	182	182	728	D Schinzel/M Wilhelmson input
Power	A	O							0	
	A	C	80	560	1,030	1,470	2,820	3,010	8,970	See separate note by M Nessi 10-01-2002
Power distribution system	A	O	0	0	0	0	0	0	0	
	A	C	0	20	25	25	35	35	140	Service contract (ST) for periodic inspection of power connections
Heavy transport	A	O	0	60	60	60	60	60	300	Area mgmt (safety, cleaning, storage)
	A	C	0						0	
Cranes	A	O	0	60	60	60	120	120	420	7 cranes in Pit 1, 6 operators @60kCHF/FTE '03-05 of which 1 for sa
	A	C	5	30	60	60	60	60	275	1.5% of capital value/y
Cars	A	O	0	0	0	0	0	0	0	
	A	C	0	30	30	30	30	30	150	CERN cars for TCn operate at Point 1
Cars	B	O							0	
	B	C							0	
Safety & radioprotection	C	O							0	
	C	C							0	
INB compliance	C	O							0	
	C	C							0	
Radioactive waste disposal	C	O							0	
	C	C							0	
Access system	C	O							0	
	C	C							0	

Elevators	C	O							0	
	C	C							0	
Gerant de site	C	O							0	
	C	C							0	
Flood control	C	O							0	
	C	C							0	
Insurance (CERN standard)	C	O							0	
	C	C							0	
Cleaning	A	O							0	
	A	C		0	0	0	0	0	0	
Cleaning	C	O							0	
	C	C							0	
Survey	A	O	60	110	210	210	110	60	760	See note from C Lasseur
	A	C	0	0	0	0	0	0	0	
Survey	B	O							0	
	B	C							0	
Passive storage space	A	O							0	
	A	C							0	
Passive storage space	B	O							0	
	B	C							0	
Common desktop infrastructure	A	O	0	0	0	0	0	0	0	
	A	C	20	20	20	30	30	30	150	PCs, WSs, terminals for technical crews
Office space	C	O							0	
	C	C							0	

Consultancy	Type	0	100	100	100	130	130	560
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Reviewing	A	O							0	
	A	C							0	
Engineering	A	O	0	100	100	100	130	130	560	Academic subsistence. Entry requested by SG
	A	C							0	
Training	A	O							0	
	A	C							0	

Outreach	Type	50	50	50	125	200	125	600
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Outreach	A	O				50	100	50	200	PJAS to run website (media events)
	A	C	50	50	50	75	100	75	400	Material for schools, public

GRAND TOTALS		403	1,641	2,628	3,496	6,334	6,419	20,921
A TOTAL		403	1,641	2,628	3,496	6,334	6,419	20,921
B TOTAL		0	0	0	0	0	0	0
C TOTAL		0	0	0	0	0	0	0



**SUMMARY OF ATLAS  
TECHNICAL COORD. PER  
TYPE**

***TCn & General***

	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>Total</i>
Mechanics	O 96	548	889	1,026	1,872	1,772	6,203
	C 131	408	549	761	1,357	1,352	4,558
Electronics	O 0	0	0	0	0	0	0
	C 175	685	1,190	1,710	3,105	3,295	10,160
Cryogenics	O 0	0	0	0	0	0	0
	C 0	0	0	0	0	0	0
TOTALS	403	1,641	2,628	3,496	6,334	6,419	20,921

10-Mar-02

**SUMMARY OF M&O(B) kCHF**

<b>EXPERIMENT: ATLAS</b>											
<b>Subsystem:</b>	<b>ID&amp;TileCal&amp;LAr&amp;Muons</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>TOTALS</b>
	Mechanics	0	0	0	40	205	205	200	200	200	<b>1050</b>
	Gas-system	65	85	105	280	660	660	660	660	660	<b>3835</b>
	Cryo-system	10	10	5	5	30	30	30	30	30	<b>180</b>
	Cooling system	0	0	0	65	265	315	315	315	315	<b>1590</b>
	FE electronics	0	0	0	100	580	1330	780	780	780	<b>4350</b>
	Standard electronics, PS (LV, HV)	25	25	25	95	290	290	390	390	390	<b>1920</b>
	Standard electronics, Crates	365	245	180	175	355	475	565	565	565	<b>3490</b>
	Standard electronics, RO Modules	100	70	40	70	225	460	460	460	460	<b>2345</b>
	Controls, (DCS, DSS)	25	25	20	25	165	195	195	195	195	<b>1040</b>
	Sub-Detector Spares	0	0	0	0	0	800	800	800	700	<b>3100</b>
	Areas	230	250	235	290	650	650	650	240	240	<b>3435</b>
	Communications	0	0	0	0	20	20	20	20	20	<b>100</b>
	Store Items	10	10	10	240	305	355	355	350	350	<b>1985</b>
	Hired Manpower @ CERN (CHF)	85	95	145	845	2,560	2,210	2,205	3,005	2,205	<b>13355</b>
	Technical Manpower @CERN (FTE)	4	5	10	25	19	19	14	14	14	<b>124</b>
	<b>TOTALS (excl. FTEs)</b>	<b>915</b>	<b>815</b>	<b>765</b>	<b>2230</b>	<b>6310</b>	<b>7995</b>	<b>7625</b>	<b>8010</b>	<b>7110</b>	<b>41775</b>
	Spares paym.advcmnt profile	2900	2034	1803	733	0	0	100	0	0	7570

10-Mar-02

## M&amp;O(B) kCHF

EXPERIMENT: ATLAS											
Subsystem: ID	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTALS	
Mechanics	0	0	0	0	0	0	0	0	0	0	0
Gas-system	40	40	40	190	380	380	380	380	380	2210	See SS note
Cryo-system	0	0	0	0	0	0	0	0	0	0	0
Cooling system	0	0	0	65	65	65	65	65	65	390	See SS note
FE electronics (spares)	0	0	0	0	0	400	400	400	400	1600	FE spares, arranged as payment advance
Standard electronics, PS (LV, HV)	0	0	0	0	90	90	240	240	240	900	5% of CORE (PSs: LV and HV/bias, PatchPanel3, PP2)
Standard electronics, Crates	60	35	20	20	70	140	140	140	140	765	5% of CORE (ROD/alignment crates)+pool rentals,multimeters,oscilloscopes
Standard electronics, RO Modules	40	30	20	20	145	230	230	230	230	1175	5% of CORE of readout modules+PCs+software licences
Controls, (DCS, DSS)	20	20	15	10	40	40	40	40	40	265	5% of CORE of DCS/ELMBs,safety equipment
Sub-Detector Spares	0	0	0	0	0	750	750	750	650	2900	Production of spares, arranged as payment advance, see comment
Areas											
SR-maintenance facility (buildup)	0	0	0	0	410	410	410	0	0	1230	See SS note
SR-maintenance facility (operation)	0	0	70	180	180	180	180	180	180	1150	Cleanroom maintenance and consumables, for staged items, PIXEL B-layer replacements and maintenance activities
Testbeam and irradiation	120	120	50	50	50	50	50	50	50	590	Testbeam and PS irradiation facility consumables, all three subsystems
Systemtests	80	115	100	50	0	0	0	0	0	345	Systemtest consumables for the systemtest in all three subsystems
Communications	0	0	0	0	5	5	5	5	5	25	
Store Items	0	0	0	120	170	170	170	170	170	970	
Hired Manpower @ CERN (CHF)											
Standard tasks	30	30	50	360	550	550	550	550	550	3220	Manpower: see SS note
Special interventions	0	0	0	0	450	0	0	800	0	1250	Manpower to install staged items in 2006 (PIXEL 3rd layer and TRT-C wheels), and major intervention in 2009 (example) when the entire ID is taken to i
Technical Manpower @CERN (FTE)	1	1	2	2	4	4	4	4	4	26	See SS note
<b>TOTALS (excl. FTEs)</b>	<b>390</b>	<b>390</b>	<b>365</b>	<b>1065</b>	<b>2605</b>	<b>3460</b>	<b>3610</b>	<b>4000</b>	<b>3100</b>	<b>18985</b>	
Spares paym.advcmnt profile	1100	1134	1533	733	0	0	0	0	0	4500	

21-Feb-02

**M&O(B) kCHF**

<b>EXPERIMENT: ATLAS</b>										
<b>Subsystem: LAr</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>TOTALS</b>
Mechanics	0	0	0	0	0	0	0	0	0	<b>0</b>
Gas-system										<b>0</b>
Cryo-system	10	10	5	5	30	30	30	30	30	<b>180</b>
Cooling system					50	100	100	100	100	<b>450</b>
FE electronics (spares)						350	350	350	350	<b>1400</b>
Standard electronics, PS (LV, HV)					20	20	20	20	20	<b>100</b>
Standard electronics, Crates	85	40	20	115	80	130	130	130	130	<b>860</b>
Standard electronics, RO Modules				30	50	200	200	200	200	<b>880</b>
Controls, (DCS, DSS)				10	30	30	30	30	30	<b>160</b>
Sub-Detector Spares										<b>0</b>
Areas	30	15	15	10						<b>70</b>
Communications					5	5	5	5	5	<b>25</b>
Store Items				120	110	160	160	160	160	<b>870</b>
Hired Manpower @ CERN (CHF)	15	5	5	305	780	880	880	880	880	<b>4630</b>
Technical Manpower @CERN (FTE)		1	5	7	3	0	0	0	0	<b>16</b>
<b>TOTALS (excl. FTEs)</b>	<b>140</b>	<b>70</b>	<b>45</b>	<b>595</b>	<b>1155</b>	<b>1905</b>	<b>1905</b>	<b>1905</b>	<b>1905</b>	<b>9625</b>
Spares paym.advcmnt profile	1200	200	0	0	0	0	0	0	0	1400

LAr 1.2 CHF/l; also FEC cooling gases  
Cooling for FEC systems and power supplies  
FEB spares; arranged as payment advancement  
Replacement of 1 PS per year  
Electr. pool rentals; test beam electr (VMEs); DVMs,TDRs,oscilloscopes  
On-line computing epm (PCs,RODs,links, software licences)  
Replacement of local DCS/ELMBs; safety equipment  
Test beam oper. consumables  
GSM phones, call-back  
Sheet metal for repairs  
System managers, technicians, welders, cleaners  
After 2006, incl. in hired manpower

6-Mar-02

**M&O(B) kCHF**

EXPERIMENT: ATLAS											
Subsystem: Muons	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTALS	
Mechanics				40	150	150	150	150	150	790	5% of CORE.Replacement of materials, moving parts (big wheels)
Gas-system	20	40	60	85	255	255	255	255	255	1480	Gases (Ar,C)2,N-Pentane; components 5% of capital CORE. Gas volume 900 m3
Cryo-system										0	
Cooling system					125	125	125	125	125	625	5% of capital CORE; for trigger electronics in pit. Outside shielded
FE electronics (spares)				100	550	550	0	0	0	1200	Replacement of electronics in modules, fibre optics, RO
Standard electronics, PS (LV, HV)				70	100	100	50	50	50	420	10% of capital CORE up to '07, 5% thereafter. Replacement of electronics in modules; el. po
Standard electronics, Crates	180	130	100	0	110	110	200	200	200	1230	PCs, DAQ fibre optic trans/receiver eqpm. replacements; el. pool rentals (VMEs).Staging fin
Standard electronics, RO Modules	40	20								60	Electronics pool rentals for test beams
Controls, (DCS, DSS)						30	30	30	30	120	ELMBs, safety eqpm.
Sub-Detector Spares										0	
Areas										0	
Communications					5	5	5	5	5	25	GSM phones
Store Items										0	
Hired Manpower @ CERN (CHF)	40	60	90	180	330	330	330	330	330	2020	From 2006, shutdown activities, gas & cooling operations, feasibility studies
Technical Manpower @CERN (FTE)	2	2	2	15	10	13	8	8	8	68	
TOTALS (excl. FTEs)	280	250	250	475	1625	1655	1145	1145	1145	7970	
Spares paym.advcmnt profile	600	600	270	0	0	0				1470	

Note: The spares payment advancement is managed within the Muon system

7-Mar-02

## M&amp;O(B) kCHF

These comments are mostly for after 2005

Before 2006 all is test beam; this activity continues also thereafter.

EXPERIMENT: ATLAS											
Subsystem: TileCal	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTALS	
Mechanics (incl. optics)					55	55	50	50	50	260	
Gas-system (Cs137-hydraulic drive)	5	5	5	5	25	25	25	25	25	145	repairs and modifications to tools to extract the drawers; small part replacements
Cryo-system										0	pumps, valves, filters, monitors for Cs source system
Cooling system					25	25	25	25	25	125	similar to the Cs radioactive source system
FE electronics					30	30	30	30	30	150	THIS LINE AND THE FOUR FOLLOWING LINES ARE TO BE CONSIDERED TOGETHER.
Standard electronics, PS (LV, HV)	25	25	25	25	80	80	80	80	80	500	Total of 5 lines - equal 330 kCHF/yr, of this 90 k/year is test beam as pre-2006, the remainder
Standard electronics, Crates	40	40	40	40	95	95	95	95	95	635	is 240 k/year for FE electr. repairs, maint. /replacements of HV and f LV PS, pool
Standard electronics, RO Modules	20	20	20	20	30	30	30	30	30	230	rentals for USA15, laser system maint. and repairs, ROD crate maintenance, PCs,
Controls, (DCS, DSS); ELMBs for test-beam	5	5	5	5	95	95	95	95	95	495	software licences and DCS electronics.
Sub-Detector Spares						50	50	50	50	200	100 k - PMT spares, parts of PMT blocks, connectors etc.
Areas					10	10	10	10	10	50	Local lab for repairs; equipment rentals
Communications					5	5	5	5	5	25	Videoconferencing, GSM
Store Items	10	10	10		25	25	25	20	20	145	General operations for test beams and local repair labs.
Hired Manpower @ CERN (CHF)					450	450	445	445	445	2235	FTE - 1 DAQ, 1 calibration data, 1 electronics; Acces - 1/3 y x 4.5 FTE = 1.5 FTE
Technical Manpower @CERN (FTE)	1	1	1	1	2	2	2	2	2	14	1 sys. Manager (DCS), 1 general operations, mostly rad. Source
<b>TOTALS (excl. FTEs)</b>	<b>105</b>	<b>105</b>	<b>105</b>	<b>95</b>	<b>925</b>	<b>975</b>	<b>965</b>	<b>960</b>	<b>960</b>	<b>5195</b>	
Spares paymt. advanced profile		100					100			200	

Detailed breakdown of 5 electronics lines in "steady state" as given in reply to SG	After 2005
Replacement parts for drawer electronics repairs	30
Repairs and replacements of LV and HV power supplies: Test beam (see 2002)	50-55 25 80
Electronic pool rentals for USA15 Test beam (see 2002)	50-55 40 95
ROD crate and ROD maintenance: Test beam (see 2002)	10 20 30
PCs, software licences (DCS) Laser system maintenance and repairs ELMB maintenance and replacements Test beam (see 2002)	40-45 15-20 20-25 5 95